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Research Article

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Vertical distribution of available macro and micronutrients in soil profiles of Ganapavaram pilot area of Nagarjuna Sagar left canal command area of Andhra Pradesh

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Summary

Studies undertaken to assess the nutrient status of soils of pilot area Ganapavaram of 24 L Minor and Muktheswara Puram Major of Nagarjuna Sagar Project left canal command of Nalgonda district of Andhra Pradesh have been studied. Profile wise nutrient status in soil profiles of pilot area revealed that the soils were low to medium in available nitrogen (94 - 219 kg ha^{-1}), low to high in available phosphorus (4.4 to 45.5 kg ha^{-1}) and low to high in available potassium (98 to 482 kg ha^{-1}). The DTPA extractable available micronutrients Zn, Cu, Mn and Fe ranged from 0. 24 to 2.52 mg kg^{-1}, 1.20 to 4.59 mg kg^{-1}, 1.18 to 15.65 mg kg^{-1} and 1.67 to 49.1 mg kg^{-1} soil, respectively. Soils were low to medium in available nitrogen, high in available phosphorus and medium to high available potassium in the surface horizons and in case of available micronutrients deficient to sufficient in Zn and sufficient in available Cu, Fe and Mn in the surface layers of the soil profiles.

Key words : Available N, P, K, Available micronutrients

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Introduction

The soils of NSP left canal command mostly consist of red sandy loams locally known as chalka soils followed by mixed sandy loams (dubba soils) together constitutes 2.85 lakh ha (75%) of the area. The 0.95 lakh ha (25%) of area belongs to clay and clay loam soil (Black cotton soils). The soil fertility status exhibits the status of different soils with regard to amount and availability of nutrients essential for plant growth. The crop growth and yield largely depend upon potential of soil resources and their characteristic provides water, nutrients and anchorage for the growth and yield of crops. The available macro and micronutrients in the soil profiles aid in determining the soil potential, which are essential for better scientific utilization of crop growth.

Such soils database is of limited availability, In order to provide a base line data and information, the present study is taken up in soils of Ganapavaram pilot area of Nalgonda district of Andhra Pradesh which are distributed mostly on gently slopping and pediplains and characterized by low lying flat terrain topography.

Resource and Research Methods

Location and site characteristic of study area :

The total geographical area of the Ganapavaram village is 1197 ha is bounded between 17^0 Northern latitude and 80^0 eastern longitude. On eastern side Yathirajapuram thanda, western side Ganapavaram village, southern Mangalkunta thanda and northern Thogarrai village. The pilot area extending over an area of 240 ha. Physiographically contiguous to the Mysore plateau and slopes from west and northeast to southeast. The general elevation varies from 480 m to 80 m above mean sea level and the elevations of selected pilot area was 95 m above mean sea level . The major geomorphic units recognized in the pilot area are, *dissected pediments* and *pediplains*. Nearly three fourth of the pilot area is under *pediplains* and characterized by low lying flat terrain.

The climate of the selected pilot area is Semi Arid type and temperature begins to rise after February and the hottest month is May with maximum temperatures up to 44^0C, and the minimum temperatures ranges from 12-14^0C in the months of December/January. The southwest monsoon contributes 70 per cent of the annual rainfall from June to September. Occasionally rainfall receives from November onwards due to cyclonic depression in the Bay of Bengal. The soil moisture control section is dry for more than 90 cumulative days or 45 consecutive days in the months of summer solstice. So it qualifies for Ustic soil moisture regime. The soils are developed on granite, gneiss parent material. The natural vegetation includes grasses *Cynodon doctylon*, Neem (*Azadiracha indica*), Babul, *Acacia* sp., *Prosopis juliflora*, mango (*Mangifera indica*), teak (*Tectona grandis*), *Tamarindus indica, Kalajamun, Zizyphus jujuba* etc. The twelve typical pedons were selected for study based on physiography and morphological features representing nearly level to gently slopping topography. The soil samples representing each horizon of the pedons were collected and characterized for physico-chemical properties and available nutrient status by using standard procedures.

Research Findings and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Soil physico-chemical properties of study area :

All the pedons studied were neutral (6.8) to moderately alkaline (8.6) in reaction and appear to be related with parent materials, rainfall and topography (Thangaswamy *et al.*, 2005). Higher organic carbon content and lower soil pH values were recorded in surface horizons as compared to subsurface horizons. The increasing trend in pH with depth could be due to increase in accumulation of exchangeable Na^+ and $CaCO_3$. The low E.C values varied from (0.05-0.86 dSm^{-1}), suggesting low amount of soluble salts could be attributed to loss of bases due to heavy rainfall (Sidhu *et al.*, 1994). Organic carbon content of the soils was very low to high (0.1-0.85%). The organic carbon content decreased with depth of the pedons except in pedons 2, 5, 6 and 10. These could be attributed due to the addition of farmyard manure and plant residues to surface horizons than in the lower horizons. The removal of surface soil containing high organic carbon due to erosion was found to be a factor for the lower organic carbon content in the surface soils of pedons 2, 5, 6 and 10.

Nutrient status and soil fertility :

Available macronutrients :

The soil fertility status exhibits the status of different soils with regard to amount and availability of nutrients essential for plant growth. The available nitrogen content of all the pedons (Table 1) ware low to medium in range varied from 94-219 kg ha^{-1} through out the depth. However, available N content was found to be maximum in surface horizon and decreased regularly with soil depth, which might be due to the confinement of falling of plant residues and debris and rhizosphere of plants and might be due to decreasing trend of organic carbon with depth. These observations are in accordance with the findings of Prasuna *et al.* (1992). The available phosphorus content in the horizon of the pedons varied from 4.4 to 45.5 kg ha^{-1}. However, the highest available P was observed in the surface horizons and decreased regularly with depth. The reason for higher P in surface horizon might possibly be the confinement of crop cultivation to the rhizosphere and supplementing of the depleted phosphorus through external sources *i.e.* fertilizers.Similar results were reported by Thangaswamy *et al.* (2005). The content of available K in all the pedons varied from 98 to 482 kg ha^{-1}. The highest available K content was noticed in the surface horizons and showed decreasing trend with depth. This could be attributed to

Table 1 : Soil physico-chemical properties and available nutrient status of the study area

Location of profile	Depth (Cm)	pH (1:2.5)	EC (dSm^{-1})	OC (%)	Available macronutrients (kg ha^{-1})			Available micronutrients (mg kg^{-1})			
					N	P	K	Zn	Cu	Mn	Fe
Profile –1Tailend reach of 24 L-1											
	0-13	7.41	0.09	0.80	183.0	42.7	340	0.63	2.13	4.6	12.38
	13-28	7.50	0.10	0.50	154.7	15.3	288.	0.4	1.98	2.45	5.10
	28-43	7.50	0.11	0.50	154.7	11.6	199	0.34	2.99	4.37	3.48
	43-60	7.55	0.28	0.10	118.9	10.4	168	0.35	2.44	3.95	1.32
Profile -2 Tail end reach of 24 L-2											
	0-13	7.52	0.08	0.70	172.6	25.4	304	1.55	1.99	1.54	6.36
	13-21	7.74	0.09	0.20	127.9	10.0	173	0.58	2.08	2.04	5.16
	21-35	7.70	0.11	0.50	154.7	8.0	169	0.41	2.08	2.88	3.90
	35-50	7.71	0.13	0.30	136.8	4.4	144	0.36	2.5	1.18	1.60
Profile -3 Tail end reach of 24 L-3											
	0-5	6.95	0.05	0.60	163.6	35.3	270.2	1.59	3.64	2.5	18.19
	5-30	7.09	0.05	0.30	136.8	8.5	118.5	0.37	2.59	7.25	3.81
	30-41	7.11	0.15	0.30	136.8	8.0	99.7	0.41	2.41	4.67	1.32
Profile -4 Tail end reach of 24 L-4											
	0-5	7.21	0.30	0.70	163.6	31.1	295	2.52	4.59	6.35	28.74
	5-20	7.44	0.11	0.60	136.8	25.8	205	0.4	3.15	5.77	3.30
	20-32	7.73	0.15	0.30	136.8	20.7	150.1	0.26	2.31	3.33	1.23
Profile -5 Tailed reach of 24 L-5											
	0-13	7.7	0.48	0.75	177	29	482	0.4	4.50	6.35	25.4
	13-30	8.0	0.25	0.45	140	20	358	0.33	2.15	4.74	11.00
	31-55	8.6	0.22	0.50	150	19	302	0.29	1.81	3.76	10.64
	55-90	9.0	0.68	0.18	167	18.5	270	0.30	1.81	4.10	13.10
Profile -6 Mid reach of 24 L-6											
	0-16	7.5	0.09	0.65	217	32	594	0.42	1.89	4.19	4.87
	16-32	8.2	0.11	0.40	194	22.6	202	0.35	1.88	3.14	1.77
	32-50	8.3	0.11	0.42	114	15.2	190	0.37	2.16	3.1	1.73
Profile -7 Mid reach of 24 L-7											
	0-13	7.9	0.15	0.74	205	32.5	290	1.14	1.68	2.39	1.67
	13-29	8.1	0.16	0.56	186	23.6	166	0.41	1.71	2.71	2.63
	29-45	8.4	0.20	0.35	104	10	128	0.28	1.51	2.91	0.75
	45-55	8.4	0.22	0.22	104	9.6	124	0.24	1.49	2.90	0.68
Profile -8 Mid reach of 24 L-8											
	0-10	7.6	0.10	0.67	219	22.6	291	1.05	4.38	4.512	49.1
	10-30	7.9	0.17	0.60	189	16.5	267	0.45	3.02	12.35	5.68
	30-60	8.0	0.17	0.20	112	11.2	247	0.36	2.46	5.26	2.70
	60-70	8.4	0.23	0.20	115	11.0	255	0.34	2.0	5.21	3.0
Profile -9 Mid reach of 24 L-9											
	0-12	7.6	0.74	0.85	198	39.4	213	0.78	4.19	3.29	47.2
	12-29	7.8	0.80	0.45	156	12.4	190	0.28	2.45	15.65	4.36
	29-45	7.8	0.81	0.39	110	7.6	154	0.36	2.23	13.77	2.85
	45-52	8.0	0.81	0.26	102	7.0	120	0.30	2.34	13.99	2.95
Profile -10 Upper reach of 24 L-10											
	0-15	6.8	0.19	0.55	225	30.5	209	0.763	4.46	4.39	15.4
	15-40	6.9	0.29	0.60	189	36.5	145	0.66	3.00	9.58	8.72
	40-65	7.2	0.42	0.20	94	8.8	110	0.29	2.46	6.46	5.60

Table 1: Contd.……

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Profile -11 Upper reach of 24 L-11										
0-13	6.8	0.19	0.60	217	45.5	218	0.77	2.13	5.29	3.43
13-41	6.9	0.29	0.50	195	11.5	156	0.39	1.70	5.49	8.42
41-60	7.2	0.42	0.30	107	6.0	123	0.37	1.56	6.68	4.60
60-68	7.4	0.43	0.20	109	5.0	129	029	1.20	6.90	12.3
Profile -12 Upper reach of 24 L-12										
0-16	7.5	0.25	0.56	185	40.5	293	0.58	3.64	8.37	3.77
16-35	7.5	0.28	0.57	136	13.6	236	0.42	2.89	10.10	2.70
35-50	7.6	0.86	0.30	102	8.4	111	0.38	2.50	12.28	1.67
50-59	7.7	0.80	0.20	99.0	8.4	116	0.33	2.47	9.6	4.00

more intensive weathering, release of labile-K from organic residues, application of K fertilizers and upward translocation of K from lower depths along with capillary rise of ground water. Similar results were reported by Pal and Mukhopadyay (1992).

Available micronutrients :

The DTPA extractable available Zn content varied from 0.24 to 2.52 mg kg^{-1} soil (Table 1). Vertical distribution of zinc exhibited little variation with depth considering 0.60 mg kg^{-1} as critical level (Lindsay and Norvell, 1978). These soils were deficient to sufficient in surface layers and deficient in sub surface layers of all the profiles which might be due to accumulation of comparatively less or more amount of organic matter in surface layers than subsurface layers as reported by Jalali *et al.* (1989) and Nayak *et al.* (2000). All the pedons were found to be sufficient in available Cu content (1.20 to 4.59 mg kg^{-1}) as all the values were well above the critical limit of 0.20 mg kg^{-1} soil as suggested by Lindsay and Norvell (1978). A decreasing trend with depth was noticed in all the pedons except 1 and 9, which were showing irregular trend with depth. The available copper was more in surface layers and decreased with depth, which might be due to its association with organic carbon affecting it availability in surface layers.

The available Mn content of these soils varied from 1.18 to 15.65 mg kg^{-1} soil. It was high in the surface horizons and gradually decreased with depth in 4 and 7 pedons, which might be due to its presence in the reduced forms in surface and subsurface layers and higher biological activity and organic carbon in the surface soils. These observations are in agreement with the findings of Murthy *et al.* (1997) and Nayak *et al*. (2000). The DTPA extractable Fe content varied from 1.67 to 49.1mg kg^{-1}. According to critical limit of 4.5 mg kg^{-1} of (Lindsay and Norvell, 1978) the soils were sufficient in available iron except profiles 11 and 12, which might be due to the accumulation of iron. A decreasing trend with depth was noticed in 1, 2, 3, 4, 6, 7 and 10 pedons. It might be due to accumulation of humic material in the surface layers besides prevalence of reduced conditions in sub surface layers. The findings are in agreement with the findings of Nayak *et al*. (2000) and Prasad and Sakal (1991).

Conclusion :

Chemical characteristics of soils in Ganapavaram pilot area of 24 L Minor under M.P. Major of Nagarjuna sagar Project left canal command of Nalgonda district of Andhra Pradesh have been studied. Studies under taken to assess the profile wise nutrient status regarding to the macro and micronutrients in soil profiles. Soils were low to medium in available N, high in available P and medium to high available K in the surface horizons and deficient to sufficient in Zn and sufficient in available Cu, Fe and Mn in the surface layers of the profiles.

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